

Summary Report of March 2011 Chinook Salmon Facility Efficiency Experiments

Investigators

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Summary

The U.S. Bureau of Reclamation's Tracy Fish Collection Facility (TFCF) located in the southern Sacramento-San Joaquin Delta (Delta) was designed to divert juvenile Chinook salmon (*Oncorhynchus tshawytscha*) and striped bass (*Morone saxatilis*) from Delta Mendota Canal (DMC) flows, thereby preventing entrainment loss to the downstream Jones Pumping Plant (JPP, Central Valley Project; Bates *et al.* 1960). Fish entrainment is defined as "the incidental trapping of any life stage of fish within waterways or structures that carry water being diverted for anthropogenic use" (NMFS 2010). The TFCF uses a louver-bypass system to intercept and guide fish from DMC entrainment into collection tanks, where they are held until they are truck-transported back to the Delta and away from the immediate influence of the JPP. Fish and exported flows enter the facility underneath a surface debris collector (trash boom), through a trashrack with 5.1 cm (2.0 in) wide bar spacing and the 25.6-m-wide (84-ft-wide) primary channel to one of four bypass entrances along the louver wall. Once inside a bypass entrance, fish move into underground concrete pipes to the secondary channel where they encounter a double-louver wall. Fish guided successfully by these louvers are diverted to one of four fish collection tanks. Although the louver/bypass components were designed to screen and salvage fish from exported flows, there are many potential areas where fish loss can occur, and the facility is reportedly not 100% effective (Karp *et al.* 1995; TFCF unpublished data).

Chinook salmon abundance is declining in the Delta due in part to non-native fish introductions, and habitat alterations from long-term operations at JPP and California's Harvey O. Banks Pumping Plant (Moyle 2002; NMFS 2006, 2009). Recently, NMFS completed a biological opinion stating TFCF operations are likely to jeopardize the continued existence of the endangered Sacramento River winter-run Chinook salmon and threatened Central Valley spring-run Chinook salmon (NMFS 2009). This past spring,

we conducted several fish release/tagging experiments to help evaluate louver efficiency for juvenile Chinook salmon. The purpose of this plan is to summarize those results.

Problem Statement

Chinook salmon are declining in the Central Valley of California and two races are protected by the National Marine Fisheries Service (NMFS) (winter and spring runs; NMFS 2005). Fall- and late-fall run Central Valley Chinook salmon are considered Species of Concern (NMFS 2006). Recently, NMFS determined operations of JPP may adversely affect the existence of the endangered winter-run and threatened Central Valley spring-run Chinook salmon (NMFS 2009).

Goals and Hypotheses

Goal:

1. Determine facility efficiency for a range of JPP conditions at the TFCF:
1–5 JPP pumps in operation: determine facility efficiencies when secondary channel velocity is constant (>0.9 m/s, 3 ft/s) and primary BR varies (but always >1).

Materials and Methods

We will use release recapture experiments to measure facility efficiencies. We will determine which type of test will be performed depending on the number of pumps in operation at the JPP in March/April 2011.

Juvenile Chinook salmon (4,300) will be obtained from either Mokelumne or Feather River Fish Hatcheries (California Department of Fish and Game) in late February 2011. Fish will be held in flow-through 750-L (198-gal) tanks in well water (18°C) and fed Silver Cup salmon feed. Two weeks prior to testing, 4,200 fish will be fin tagged with fluorescent microbeads (New West Technology, Arcata, California) into the following tag groups: Tags 1–6: 500 fish each (24 primary channel releases, 12 day/12 night); Tags 7–12: 180 fish each (24 secondary channel releases, 12 day/12 night). One hundred fish will be fin-clipped for holding tank control releases. These fish are released to test whether the lift bucket and screen are securely in place in each experiment. Experimental fish will be acclimated to ambient Delta water conditions for 7 days prior to use.

For each experiment (3 replicates/24-h period), 100 fish will be released at 5 locations (20/location) just downstream of the trashrack, 40 fish released at the anterior end of the secondary channel, and 10 fish released into the holding tank. Each morning before the experiments begin, the trashrack and primary louver array will be cleaned. Then the secondary louver arrays will be cleaned and predators removed from the secondary channel. We will begin preparation for an experiment by counting test fish and placing them in 18.9-L (5-gal) buckets (20 fish/bucket). While counting takes place, the target secondary channel velocity is achieved by manipulation of the VC pumps. Once target hydraulics are established and stabilized, Replicate 1 for that 24-h period will begin. This will be repeated 30 and 60 min later for a total of three experimental releases per 24-h period. Holding tank and sieve net samples will be taken simultaneously every one half hour for 2 h. Recovered fish will be sorted by color code and measured.

Hydraulic measurements will be taken every 30 min throughout each experiment to ensure that average secondary channel velocity remains within the acceptable target condition range (± 0.06 m/s). Hydraulic data include channel velocities and depths in the primary and secondary channels, discharge in the secondary channel and holding tank, primary and secondary channel bypass ratios, and ambient light condition.

Data Analyses

WFE will be calculated using:

$$\text{WFE} = (\# \text{ recovered in the holding tank} / 100) \times \text{Holding Tank Efficiency (HTE)}$$

We will also include an analysis of the acoustically tagged fish released in March 2011.

Coordination and Collaboration

These studies will be coordinated with the California Department of Fish and Game's Delta diversion facilities reporting program, and the TFCF staff. All work will be reviewed by the Tracy Technical Advisory Team through progress updates on request and reviews of study plans and all reports.

Endangered Species Concerns

Incidental "take" of ESA listed salmon, steelhead (*O. mykiss*), and delta smelt (*Hypomesus transpacificus*) is possible and such fish will be returned to Delta waters as quickly as possible. The total number of each ESA species incidentally caught or collected during the experiment will be recorded and sent to the reporting agencies. The incidental take from this research is covered under the TFCF Section 10 permit.

Dissemination of Results (Deliverables and Outcomes)

Provide draft and final summary report of experimental findings by September 30, 2012.

Literature Cited

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